In the deevlopment of the nervous system there are formed transitory giant ganglion cells which are shut out of the central nervous system and persist for a long time lying outside the cord. They apparently form a transitory larval nervous system, possibly analogous to the subumbrellar cells described by Kleinenberg as ushering in the permanent ventral cord in Lopadorhynchus.

In the *Verhandlung* of the third meeting of the German Anatomical Soclety, Karl Bardeleben presented evidence for the existence of a sixth normal toe in the Mammalia. He finds in the skeletons of several forms bones on the radial side of the hand which he regards as evidence of a finger outside of the thumb, to which he gives the name prepollex; the corresponding structure in the foot is the prehallux. The existence of these additional digits has been seriously questioned, the bones being regarded as sesamoid. In *Pedetes capensis*, however, Bardeleben finds a true sixth finger which is furnished with a nail, and which seems to represent a thumb in function. Tornier, at the meeting, regarded these sixth fingers and toes in the Mammalia as physiologically new structures, not as ancestral features.

EMBRYOLOGY.

Evolution of the Medullary Canal.—Under this head we have to consider, first, what is the primitive vertebrate type of the central nervous system; second, what genetic relation existed between the vertebrate and invertebrate types.

The opinion generally accepted by embryologists is that the typical vertebrate canal is formed by the closure of the medullary groove. This view is advocated by Balfour, and has been so thoroughly accepted by Adam Sedgwick that he has made it the basis of a speculation[1] on the original function of the canal; he supposes that it was open behind and excretory; the cilia which are found in the central canal of the spinal cord originally served to produce the excretory current. This opinion overlooks the serious difficulty of assuming that the canal is primitive, while in the lowest vertebrates it is clearly a secondary modification. In Petromyzon, Lepidosteus and Teleosts, the medullary plate, instead of becoming the floor of an external groove, forms a solid keel-like projection towards the ventral

[1] A. Sedgwick. On the Original Function of the Canal of the Central Nervous System of Vertebrata. Proc. Philos. Soc. Cambridge, Eng. IV., 325–328.

surface. This keel subsequently becomes separated from the superficial layers of the ectoderm, and afterwards a central canal is developed in it. In the ganoids, which approach the elasmobranchs in structures there is, as shown by Selensky[2] a medullary groove of peculiar form, which suggests a transition from the solid keel to the open groove; again in amphibia there is evidence that the delamination is still preserved to a slight extent in that group. These considerations lead me to the hypothesis that the nervous system of vertebrates was primitively a solid axial thickening of the ectoderm, and within the class of ganoids became modified into a groove, perhaps simply by more precocious development of the central canal; the groove type has been kept in elasmobranchs, amphibians and amniota. Balfour (Comp. Embryol., II., 303) thus defends the opposite view: "It seem, almost certain that the formation of the central nervous system from a solid keel-like thickening of the epidermis is a derived and secondary mode; and that the folding of the medullary plate into a canal is primitive. Apart from its greater frequency, the latter mode of formation of the central nervous system is shown to be the primitive type by the fact that it offers a simple explanation of the presence of the central canal of the nervous system; while the existence of such a canal cannot easily be explained on the assumption that the central nervous system was originally developed as a keel-like thickening of the epiblast."

It is not possible at present to decide positively between the two views, but the view which I am inclined to adopt is further justified by the development of the central nervous system in annelids, which is formed by the coalescence of a pair of linear cords: these cords arise each side of a cilated longitudinal furrow, first as a single row of ectodermal cells, subsequently as several rows; while still united to the external ectoderm they extend towards one another below the ciliated cells of the furrow, and unite in a single nervous band. In leeches and arthropods the development is very similar. In all these cases the bands split off from the ectoderm. It appears, then, that in the nearest[3] invertebrate allies of the vertebrates the nervous system develoopes as a thickening along the inner surface of the ectoderm, and delaminates from that layer. It seems to me very natural to suppose, therefore, that the strikingly similar process in the lowest vertebrates is the primitive one, and that the canalization of the medullary plate was evolved within the vertebrate series.

[2] W. Salensky. Recherches sur le développement du sterlet (*Accipenser ruthenus*). *Arch. de Biol.*, II., 233–341. Taf. XV.–XVIII.

[3] With, of course, the possible exception of Amphioxus.

I have assumed that the ventral nerve cords of annelids are homologous with the medullary canal, a view that is now generally accepted by embryologists. Balfour (Works I., 393, and Comp. Embryol., II., 311) has suggested a more complicated relation in his hypothesis that the lateral nerve trunks which are known in many of the lower worms (*e. g.*, nemerteans) have fused on the ventral side, in annelids on the dorsal side, of the body in the vermean ancestors of vertebrates. In favor of this ingenious surmise no evidence has since been found. Hubrecht denies the homology of the annelidan nerve chain and the vertebrate medulla; he considers [4] that the more primitive condition is represented by certain nemertean worms, which, besides two main lateral nerves, have a small longitudinal median nerve; the lateral nerves gave rise to the nerve chain of annelids by their fusion, the median nerve to the medulla of the ancestors of vertebrates. As no intermediate forms, either adult types or embryonic stages, are known to represent any phase of this double metamorphosis, I cannot admit that Hubrecht's bold speculation invalidates what seems to me the well established homology between annelids and vertebrates.—CHARLES SEDGEWICK MINOT.

ARCHÆOLOGY AND ETHNOLOGY.

The Recent Accessions to the Museum of the Peabody Academy of Science of Salem, Mass.—The accessions to the Museum of the Peabody Academy of Science, in East India Marine Hall, have, from time to time, been noticed in these columns. In no single year since the formation of this institution have these accessions been so numerous or of so valuable a character. Prof. Edward S. Morse, as is well known, was absent for several months in Japan and the east, for the purposes of study and forming collections, one of his chief objects being to obtain for our museum a characteristic and complete collection to illustrate the ethnology of Japan.

The museum previously contained but few specimens from this country, although some of these few were very valuable, while China, India, Africa, and the South Sea Islands, were fully represented. Our mercantile relations with Japan were insignificant during the time of Salem's commercial period, the time when the East India collection was formed, and indeed it is only since the opening of that country to

[4] A. A. W. Hubrecht. The Relation of the Nemertea to the Vertebrata. *Quart. Jour. Micros. Sci., N. S.*, XXVII., 605-644, Pl. XLII.